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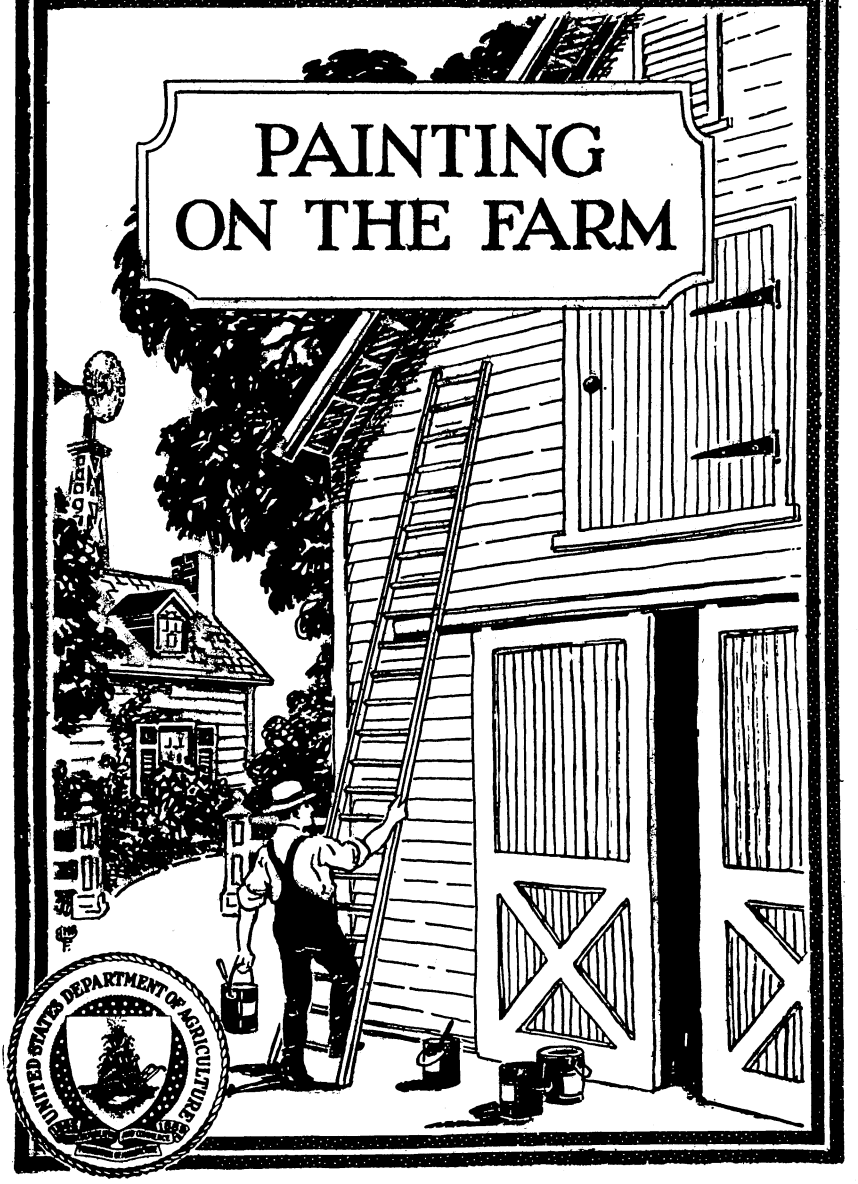
PAINTING ON THE FARM



THIS BULLETIN describes various kinds of paint and tells how to select the right kind for any purpose. It gives directions for mixing paint on the job, for preparing surfaces, and for applying the paint.

Full directions for making and applying several kinds of whitewash are included.

This bulletin supersedes Farmers' Bulletin 474, Use of Paint on the Farm.

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PAINTING ON THE FARM

By H. P. HOLMAN, *Chemist, Bureau of Chemistry*

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IMPORTANCE OF PAINTING

ALTHOUGH a coat of paint adds greatly to the appearance of a building or a piece of farm machinery, the chief purpose of painting on the farm is to preserve houses, barns, and implements from the effects of the weather. Interior painting is usually done to make the home more attractive, but it also serves a useful purpose in making walls and ceilings more sanitary and dark rooms lighter.

The importance of painting has grown as the increasing cost of building materials has made it necessary to replace with less durable materials the wood and metal formerly used. Some woods, like white pine, yellow poplar, cypress, and cedar, and some metals, like wrought iron, zinc, copper, and brass, withstand the effects of exposure to the weather remarkably well and will last a long time with few or no applications of paint. The materials widely used to-day, such as yellow pine, cast iron, and the more common steels, however, deteriorate rapidly on exposure and need to be painted frequently. Even sheet iron that has been tinned or galvanized to prevent rusting usually should be painted because of imperfections in the coating.

Painting at regular intervals is the cheapest way to keep buildings and implements in good condition.

WHEN TO PAINT

Painting should not be put off too long. If wood has begun to rot or iron has begun to rust, the rotting and rusting will continue after the paint has been applied. Moreover, the longer painting is delayed, the more difficult and expensive it becomes. Painters often spend more time and effort in preparing surfaces that have been too long neglected than in painting them.

New wooden buildings should have a priming coat of paint as soon as the weather permits; their finishing coats should be put on within the next month or two. Tinned roofing should be painted as soon as it has been laid. Galvanized sheet iron may be allowed to weather for a year, usually with no injurious effects, to give paint a better foothold. Both the wooden and metal parts of implements and machinery should be painted before they are exposed to the weather or to a damp atmosphere. All surfaces should be repainted as soon as they show signs of being imperfectly protected. The durability of paint depends upon its composition, the kind of surface to which it is applied, and the conditions to which it is exposed. Outside painting usually does not give satisfactory protection for more than from three to five years, and sometimes not for as long as that.

Although spring and fall are the favorite seasons for outside painting, it is not necessary to put it off if the need for it becomes apparent in the summer or winter. Outside painting can be done whenever the surfaces are dry and the weather is not damp, frosty, or freezing. Best results are obtained when the temperature is between 60° and 80° F. Painting can be done in heated buildings at any time. Cool, dry weather is best for calcimining, however.

PAINT MATERIALS

All paint, whether it is bought ready mixed or mixed on the job, consists of a solid (the pigment) in a liquid (the vehicle). The pigment, a very finely divided solid, gives the paint its power to hide and color a surface. The vehicle makes it possible to spread the pigment over the surface, and upon drying binds the pigment particles to the surface and to one another. As a rule both pigment and vehicle are mixtures.

PIGMENT

Materials which make up the greater part of the pigment mixture are called base or body pigments. All light-colored or tinted paints have a white base. Dark paints may contain a dark base pigment mixed with other pigments, or they may contain only one dark pigment. The pigments other than the white pigment in a light-colored paint are known as the color or tinting material.

WHITE PIGMENTS

White lead.—Practically all light-colored paints for outside surfaces contain white lead, usually mixed with smaller quantities of other pigments.

Originally white lead meant basic carbonate of lead, but within recent years the term has been applied also to basic lead sulphate, originally called sublimed white lead. When used alone, each of

these pigments gives a comparatively soft paint film, which becomes chalky on weathering. The carbonate is darkened rapidly when exposed to air containing sulphide gas and is readily dissolved by acids. If taken into the human system by breathing in the dust caused by sandpapering painted surfaces, it may cause lead poisoning or colic. The basic sulphate is less readily darkened by sulphide gas and is somewhat less poisonous than the carbonate.

Ground in linseed oil to a heavy paste, white lead can be bought almost anywhere in 12½, 25, 50, or 100 pound kegs and also in 300 and 500 pound casks. One or five pounds can usually be bought in compression-top cans. The cost per pound increases as the size of the package decreases. Dry white lead, which is handled by some dealers, is used in making lead putty, but not often for mixing paints.

Lead sulphate.—Ordinary sulphate of lead (not basic), which is white, sometimes forms part of ready-mixed paints. It is much less poisonous than the carbonate and is not darkened by sulphide gas. It does not hide surfaces as well as the basic carbonate and basic sulphate of lead, however.

Zinc oxide.—Zinc oxide (zinc white) is added to white lead in most ready-mixed white and light-colored paints to give a harder and more durable paint film. As its films are very hard and soon crack on weathering, it is not used alone in outside oil paints, but commonly forms from 25 to 50 per cent of the total pigment.

The higher grades of zinc oxide, produced from metallic zinc by the so-called French process, are whiter than white lead and are frequently used in outside white paints and in first-class enamels. The lower grades of zinc oxide, produced directly from zinc ore by the so-called American process, are tinged with yellow and usually contain lead sulphate. The color of zinc oxide is not noticeably changed by exposure to sulphide gas.

Both the dry pigment and the paste, in 1 and 5 pound cans, are sold by many paint dealers. As a rule, the higher grades are too expensive to be used in the preparation of ordinary house paints, and the cheaper grades are sold by comparatively few dealers. Zinc oxide packed in kegs like white lead is sometimes sold under trade names.

Lithopone.—Lithopone (about 30 per cent of zinc sulphide and 70 per cent of barium sulphate) is used principally in flat-finish wall paints and interior enamels. One of the chief objections to its use in outside paints has been that it turned dark gray when exposed to direct sunlight. Several brands which are said to be unaffected by light are now being manufactured. Some authorities hold that exposure to the weather causes the zinc sulphide in lithopone to change to the soluble zinc sulphate, which would be removed from paint films by rain. Lithopone is sold in retail paint stores only as ready-mixed paint.

Miscellaneous white pigments.—Titanium oxide, which has not yet come into extensive use, is not discolored by sulphide gas, is not poisonous, and is said to be satisfactory when properly mixed with other pigments. Titanox is a mixture of titanium oxide with a larger proportion of barium sulphate. Antimony oxide is said to be satisfactory when properly mixed with other pigments, but, because of its high cost, it is not commonly used.

Inert pigments or extenders.—Substances which appear to be white when in the form of a dry powder but are transparent in oil are sometimes added to ready-mixed paints as fillers or extenders. The legitimate purpose of such extenders, often referred to as inert pigments, is to prevent the settling of the pigment, to reduce the tendency of a paint film to chalk on weathering, and to serve as a base for highly-colored artificial pigments. Some of the colored pigments which occur in nature contain large proportions of such material. Excessively large quantities of inert pigments are sometimes used merely to cheapen paint.

Silica and the insoluble compounds of calcium, barium, magnesium, and aluminum are commonly used as extenders. Some of these compounds, which are also used in making colored pigments, may find their way into paints because they are present in the tinting material. More than 15 per cent, on the basis of total weight, in a white or light-colored paint is not accepted in Government purchases.

The most important of the calcium compounds is the carbonate, used in the form of natural chalk (whiting), precipitated chalk, and marble dust or flour. While not used in large quantities in oil paints, calcium carbonate, as whiting, is usually the base pigment for calcimines and cold-water paints. Whiting is also mixed with raw linseed oil (about 5 parts to 1 part by weight) to make glazing putty. Calcium sulphate may be introduced into a paint by using Venetian red or by adding gypsum (terra alba), burnt gypsum (plaster of Paris), or dead burnt gypsum. Sometimes calcium sulphate forms the base pigment of cold-water paint.

Barium sulphate, which is found in many ready-mixed paints, may be added in the natural form (barytes, barite, heavy-spar) or as chemically prepared blanc fixe (permanent white). Barium sulphate properly forms a large part of lithopone, titanox, and some highly-colored pigments, such as imitation vermilions and chrome greens.

Magnesium silicates (soapstone, talc, asbestine) are frequently used as extenders and sometimes serve as the base for pigments prepared from organic dyes (lakes). Aluminum silicates, including kaolin or China clay, are also frequently used. Silica (silex) is used either in the form of pulverized quartz or sand or in the natural mineral form of tripolite. Sometimes the general term silicates is used to cover silica and the silicates of magnesium and aluminum.

COLORED PIGMENTS

Colored pigments are added to white pigments to produce tinted paints; they are also used without white pigments to produce dark paints. As a rule, tinted and dark paints give better service than white paints, under the same conditions of use and exposure.

Tinting pigments.—Yellow pigments include the chrome yellows and the yellow ochers. Medium chrome yellow is lead chromate; light chrome yellow is lead chromate and lead sulphate; orange chrome yellow is a basic lead chromate. Yellow ochers are natural earths colored with hydrated ferric (iron) oxide or similar mixtures produced artificially. The better grades, such as French ocher, are high in silica; the poorer grades are high in clay (aluminum silicates). Chrome yellows give the brighter tints; good ochers give the more permanent tints.

The brown pigments include raw sienna and raw and burnt umber, which are natural earths, high in silica, colored with oxides of iron and manganese. The proportion of manganese in siennas is usually low. Both sienna and umber give permanent tints with white bases. Raw sienna is yellowish brown, giving cream tints; raw umber is greenish brown, giving drab tints; and burnt umber is a deep, rich brown. Burnt sienna, a reddish-brown pigment, is used more often to stain or grain wood than to tint paints.

Most red pigments owe their color to the presence of ferric oxide (iron sesquioxide), which is very lasting. Indian red is almost pure ferric oxide; Venetian red consists of ferric oxide and a large proportion of calcium sulphate, calcium carbonate, or complex silicates. Organic colors (dyes), combined with inorganic substances in the form of the so-called "lakes," are sometimes used for tinting, but the tints are usually not permanent.

The black pigments owe their color to the presence of carbon. Lampblack and carbon black are almost pure carbon; bone black (ivory or drop black) consists of calcium phosphate and calcium carbonate, colored with carbon.

Of the blue pigments, Prussian blue (ferric ferrocyanide) is injured by lime and alkalies, and ultramarine blue (a complex thiosilicate) is broken down by acids. Ultramarine is used in water paints and for tinting paints having a base of lithopone or zinc oxide. Sometimes it proves unsatisfactory when used with basic carbonate white lead. Tints obtained with Prussian blue fade on exposure to light. In ready-mixed paints Prussian blue may sometimes be almost decolorized in the can, but the color will reappear as the paint dries on the surface to which it is applied.

The only green pigments commonly used in tinting are the chrome greens (mixtures of Prussian blue and chrome yellow). Medium chrome green is used most. Dark chrome green contains an excess of blue; light chrome green contains an excess of yellow, with lead sulphate or inert pigments. Tints obtained with chrome greens fade on exposure to light and are injured by lime and alkalies.

Tinting colors ground in linseed oil are generally available in 1 and 5 pound cans; some come also in 12½ and 25 pound cans. Lampblack and Prussian blue may be bought in quarter-pound or half-pound cans. The colors commonly used in tinting house paints are sold in small cans and collapsible metal tubes by dealers in supplies for artists, decorators, and sign painters. When only a trace to a quarter of a pound of colored pigment is needed, it is well to use colors in collapsible tubes. A full-size artists' tube is about 1⅛ by 3½ inches and holds about 2 ounces. The half-size tube holds about an ounce. Decorators' colors come in tubes 1¼ by 6 inches, which hold about 4 ounces.

Dry pigments are sometimes available for tinting water paints, cement, and putty, but they are not suitable for tinting oil paints.

Body pigments.—Some colored pigments, which are rarely used for tinting, are valuable as body pigments or self colors. Among these, red lead (oxide), orange mineral (a special high grade of red lead), sublimed blue lead, and American vermilion (a specially prepared basic lead chromate) are used in paints designed to keep iron from rusting. Red lead is usually available in dry form and sometimes also as an oil paste, packed in the same way as white lead. As a rule, the

dry pigment contains yellow oxide of lead (litharge), which makes the paint thicken several hours after it has been mixed.

Tuscan red is an Indian red enriched with an organic dye. Light-fast imitation vermilions (bright red paints designed for solid-color painting) consist of organic dyes, such as para red and toluidine red, on barium sulphate or silicate bases. Venetian red and red iron oxide, both comparatively cheap, are sometimes used as body pigments in dull red paints. Brick-red pigments are usually mixtures of Venetian red and yellow ocher, both of which are commonly available in dry form. The mixture comes also in paste form. Yellow ocher mixed with linseed oil is sometimes used as a priming coat on wood, but it is not suitable for this purpose.

Brown metallic, a natural iron oxide, is a cheap but excellent pigment, commonly used in paints for barns, bridges, roofs, and other places where its color is not objectionable. It is generally available in dry form and sometimes comes ground in linseed oil. The paste can be used more easily and gives a more uniform coating than the dry pigment.

The pigment in solid black paint is usually bone black (ivory or drop black) toned with Prussian blue. Black paints for metal sometimes contain graphite in combination with silicates, and sometimes carbon blacks are mixed with black oxide of iron or mineral blacks (ground slate or other dark mineral fillers). Bituminous substances, like coal-tar pitch or asphalt, and dark mineral fillers also make black paints.

The pigment in many yellow, green, and brown paints is largely barium sulphate or silicates, with enough tinting material to give the desired color and hiding power.

Distemper pigments.—Sienna, umber, ocher, Van Dyke brown, and other pigments are sometimes ground in water with a water-soluble binder to form the so-called distemper colors, which are used principally for graining.

VEHICLE

The vehicle in oil paints is usually linseed oil (sometimes mixed with varnish in ready-mixed paints), with a little liquid drier and thinner. The vehicle in enamels is essentially varnish.

PAINT OILS

Linseed oil is valuable as a paint vehicle because when it is exposed to the air it changes from a liquid to a transparent and flexible solid. China wood or tung oil, perilla oil, soya-bean oil, and other drying oils may be used in the manufacture of paints after they have received special treatments. Linseed oil, however, is the only suitable oil commonly available for mixing paint on the job.

Genuine kettle-boiled or bodied linseed oil is rarely found in retail paint stores. Ordinary boiled linseed oil, prepared by heating raw oil for a short time with a drier, is sometimes sold. Raw linseed oil, however, is the vehicle ordinarily used in outside paint mixed on the job. Boiled oil is sometimes used for mixing interior paints and priming coats put on to seal the pores of concrete, plaster, and brick.

Unless a paint oil is labeled "Linseed oil" the chances are that it is not the real thing. "Pure oil" and "boiled oil" do not necessarily mean linseed oil.

PAINT THINNERS

Thinners usually consist of turpentine or mineral spirits or a mixture of the two. The effect of a thinner is for the most part temporary; it evaporates when the paint is used. Thinners make the paint spread more easily and the oil penetrate porous surfaces more readily. If used in large quantities, thinners make oil paints less glossy, giving the surface a dull or flat finish.

Spirits of turpentine, which is generally available, is usually preferred for thinning oil paints. Wood turpentine is as serviceable as the more common gum spirits, unless it has not been properly refined, in which case it has a disagreeable odor and may cause paint to thicken or "liver." Mineral spirits is cheaper than turpentine and is satisfactory for thinning flat-finish wall paints and paints for metals. It is not as good as turpentine, however, for thinning paints to be used in priming resinous wood like yellow pine.

Ordinary gasoline and kerosene are not suitable for thinning most paints. Gasoline evaporates too quickly, kerosene too slowly. Kerosene is sometimes used for thinning creosote shingle stains, but solvent naphtha or benzol is better. Solvent naphtha and benzol are particularly well suited for thinning first-coat paints or stains to be used on new cypress wood, but, since their vapors are more poisonous than those from turpentine and mineral spirits, they should always be used with caution and never in closed spaces.

Thinners sold under the name of "Mineral turps" or "Substitute turpentine" are not really turpentine, but a cheaper material, usually straight mineral oil. Mixtures containing drying oil, volatile thinner, liquid drier, and sometimes other materials are sold for thinning paints. Some of these are satisfactory, but without definite knowledge of their composition or serviceability it is safer to use linseed oil, turpentine, and high-grade japan drier separately.

Flatting oil, sold for making dull-finish paints from white lead, is generally considered more satisfactory for this purpose than other thinners, because a larger quantity can be used without making the paint too thin.

Coal-tar creosote, which is used in mixing shingle stains, can be obtained from gas works and sometimes from paint stores.

PAINT DRIERS

Liquid driers contain substances which hasten the hardening of linseed or other drying oil. Oil driers are solutions of these substances in linseed oil. Japan driers are solutions of these substances and gums or resins in turpentine, benzine, or other liquid. When a drier is added to an oil paint the coat dries in one or two days; when no drier is added the paint may not dry for a week or longer. Too much drier shortens the life of any paint and, by causing rapid drying of the surface, may keep thick films from becoming perfectly hard as soon as they should. Japan drier made with turpentine is more popular than any of the other grades. Pale japan drier is desirable for white and light-tinted paints; dark japan is suitable for dark paints and shingle stains. Gloss oil, sometimes used as a drier, and "lightning" drier are inferior products.

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READY-MIXED PAINTS

Ready-mixed paints put out by reputable manufacturers have certain advantages over paint mixed on the job. Most of them contain materials, not available for home mixing, which give paint desirable properties, particularly in meeting special requirements, and they are more uniform because mixing can be done more thoroughly by machinery than by hand. Just the desired quantity of ready-mixed paint may be bought; when paint is prepared on the job it is necessary to mix more tinted paint than will be needed or else take a chance on having to make a second lot to match the first, an almost impossible task for anyone who is not an expert. Ready-mixed paint of any particular shade can usually be bought at any time, a great advantage in matching paint to a surface previously painted and in making the color of additions or new buildings the same as that of old buildings. Although paper color cards frequently differ decidedly from the colors of the paints they represent, wooden sample panels show just how the colors will look when dry. The results of tinting to a desired color on the job are uncertain.

The composition of paint-making materials and of ready-mixed paint is stated on the containers in all the States which have laws requiring such a statement, and also in many States where it is not required by law. Although false and misleading labels are not as common as they once were, they are still found. Any label which fails to show the exact character of the material and any fancy name or the word "compound" printed with the name of a good paint material should be regarded with suspicion. If the name and address of the manufacturer do not appear on the label, the material in question is probably an adulterated product of poor quality, with which the manufacturer does not care to have his name associated.

A detailed statement of composition on the label of a ready-mixed paint is not proof that the paint will be satisfactory, even if the ingredients mentioned are commonly recognized as good paint materials. Such a statement, however, shows whether or not the paint contains an excessively large quantity of cheap substitutes for materials generally held to be good, and enables the purchaser to know whether or not a high price is being asked for a cheap product, or, if the price is low, to decide whether he is willing to take a chance on quality. In the long run it pays to buy the paint which is most likely to be serviceable, regardless of its price.

Ready-mixed paints should be used only for the purposes for which they are sold and in accordance with the manufacturers' directions. Paint in quart or smaller cans is usually mixed by vigorous shaking before opening. Paint in half-gallon or gallon cans must be stirred. As some pigment always settles, the liquid portion of the paint should be poured into another container and, after thoroughly stirring the thick portion, poured back, a little at a time, with stirring after each addition. More thinner, in the form of linseed oil, turpentine, or a mixture of the two, may be required for preliminary coats. Directions for thinning are usually given on the cans.

OUTSIDE HOUSE PAINT

Most ready-mixed house paints which are designed especially for use on wood contain white lead and zinc oxide, sometimes in equal quantities and again with only 10 to 40 per cent of zinc. White lead and zinc oxide together should form 85 per cent or more of the total pigment in white and light-colored paints. The pigment in such paints is usually 60 to 65 per cent of the total weight. The vehicle should be pure raw linseed oil, with just enough high-grade japan drier to properly dry the paint (from 5 to 10 per cent). Since linseed oil costs more, pound for pound, than many pigments, some paints have more pigment and less linseed oil. The quantity of volatile thinner, such as turpentine or petroleum spirits, should not make up more than 10 per cent of the vehicle. The addition of gloss oil, rosin oil, fish oil, and mineral oil makes inferior paints.

The net weight per gallon (231 cubic inches) of ready-mixed white and tinted outside paints varies from about 15 to about 22 pounds, being highest in an all-lead paint. Dark ready-mixed paints weigh 9 to 14 pounds per gallon.

FLAT WALL PAINT

The pigment base of most prepared flat-finish paints is lithopone, alone or mixed with zinc oxide. About 60 per cent by weight of these paints is pigment. The vehicle is about one-third nonvolatile matter (mixing varnish or treated tung oil and drier) and two-thirds volatile thinner (turpentine, benzine, or petroleum spirits), including that in the drier. Ready-mixed flat paints have more body than flat paints made by thinning paste pigments with turpentine or mineral spirits and are not so likely to spread or creep. Interior paints usually have more liquid drier (10 to 12 per cent) than outside paints.

FLOOR PAINT[1]

Exterior floor paints contain white lead and other pigments, such as litharge or zinc oxide, which harden the paint film. The vehicle usually contains hard-drying water-resistant varnish in addition to heat-treated drying oils. Interior floor paints may contain lithopone and zinc oxide, with varnish as the vehicle.

Exterior floor paints may be used also on wagons and agricultural implements.

ENAMEL

Enamel paints, designed principally for furniture and interior woodwork, are mixtures of pigment, usually zinc oxide or lithopone, with varnish. Most enamels dry with a high gloss; some give a satin or semigloss finish; and others dry without gloss.

Special undercoaters, usually white, sold for use under enamels, consist of opaque pigments mixed with a vehicle designed to give a flat finish.

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[1] Information on interior floor paints is given in U. S. Dept. Agr., Farmers' Bul. 1219.

SPECIAL PRIMERS AND UNDERCOATERS

Ready-mixed primers are sold for coating metals, brickwork, cement floors, plastered walls, etc. The pigment in them may be the same as that in the finishing coats, but the vehicle is usually designed to make the paint adhere, close the pores, and give a good foundation for the finishing coats. Some undercoaters contain silica or similar material in place of opaque pigments, which makes them practically transparent.

CONCRETE AND CEMENT PAINT

Heat-treated drying oils or varnish gums added to the vehicle give water resistance to the special flat-finish paints for concrete, cement, stucco, and brick surfaces. When special water resistance is unnecessary and a gloss finish is not objectionable, ordinary house paints may be applied to such surfaces over suitable priming coats.

RUST-PREVENTING PAINT

Paints consisting essentially of American vermilion are most effective in retarding the rusting of iron.[2] Other pigments are often added to modify the color, and heat-treated drying oils or varnish gums are usually added to give greater water resistance to the coat.

BITUMINOUS PAINT

Paints for composition roofing are made from bituminous materials, like coal-tar pitch or asphalt, mixed with mineral fillers. Other bituminous materials are frequently added, as well as heat-treated drying oils, varnish gums, resins, and other substances. The natural black or brown color of the bitumens may be modified by the filler, but only dark colors are possible. Sometimes bituminous materials come in both liquid and solid form, the first to be used as a priming coat and the second to be melted and applied hot in finishing.

Coal-tar paints should be used on composition roofing originally treated with coal-tar products; asphalt paints on composition roofing originally treated with asphalt products. Most bituminous materials soften when exposed to hot sunshine and may run on a steep roof. In cold weather they are usually brittle.

Bituminous roof paints may be used on metal roofs, but they are not as suitable as the special oil paints for metals.

Asphaltum varnishes and japan blacks are used on metals, and special bituminous paints are used for waterproofing, acid proofing, and electrical insulating. Paints and similar coatings can not be depended upon to make wood or iron as safe from injury by acids as are earthenware, glass, hard rubber, and acid-resisting metals.

MARINE PAINT

Deck paints are similar to paints used for porch floors. Marine paints for wooden surfaces above water, good for any wooden surface exposed to salt air, usually consist of white lead and a large proportion of zinc oxide. Red-lead paints are among the best for protecting metals exposed to salt air and they can also be used on wood.

[2] Proceedings, American Society for Testing Materials, vol. 15 (1915), p. 218.

HEAT-REFLECTING PAINT

Weather-resistant aluminum paints or enamels are used on oil tanks and other surfaces where as much heat as possible is to be reflected. White or light-colored oil paints may also be used. Black and dark paints readily absorb heat, thus raising the temperature of the space beneath them.

PAINT FOR STEAM RADIATORS

Paints having a metallic luster, such as aluminum and gold bronze, often applied to steam radiators, may be bought ready mixed, or they may be prepared from the dry powder and bronzing liquid. Although these paints reduce heat radiation more than common paints and enamels,[3] they do not ordinarily interfere with effective heating.

AUTOMOBILE PAINT

The more permanent automobile finishes are usually obtained with baking japans or enamels, which are dried and hardened in ovens at high temperatures. These and other special finishes, which are fairly durable, can be applied only in factories. The materials sold for refinishing automobiles at home are usually colored pigments ground in japan for flat-finish undercoats and colored varnishes or enamels to be applied and dried at ordinary temperatures. Sometimes finishing coats of clear varnish are used, but a colored varnish usually makes a more durable finishing coat. Although good results are possible with the paints put out by reputable manufacturers, the finish obtained with automobile paints applied at home will not look as well or last as long as the original finish.

Special heat-resistant paints for engine hoods and radiators and special preparations for tops are also on the market.

"FIREPROOFING" PAINT

Fireproofing qualities are claimed for certain ready-mixed oil and water paints. Although some paints may resist fire more than others, no paint can make wood really fireproof. Ordinary paints reduce somewhat the danger of fire from sparks, cinders, and small burning bits of material, because they prevent the porous and fuzzy surfaces found on unpainted and weather-beaten wood. Special "fireproof" paints burn somewhat less readily than ordinary paints or contain substances which fuse under the influence of heat.

Fire-retarding paint should contain as little oil as possible, and lead and zinc pigments should be largely replaced by fusible, incombustible, and insoluble substances. Most substances that have fire-retarding qualities are soluble in water and soon leach out of paint films exposed to the weather. Powdered boric acid makes a paint more resistant to fire than it would otherwise be, for a short time. The use of pulverized zinc borate in preparing fire-retardant paints has been recommended by the United States Forest Service.

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[3] Journal American Society of Heating and Ventilating Engineers, vol. 26 (1920), p. 103.

LUMINOUS PAINT

Special coatings are sometimes used to make small objects visible in the dark. Such preparations are made for manufacturers and are not generally available to the public.

The most satisfactory paints of this kind owe their luminosity to an exceedingly small quantity of a radium compound or other radioactive material in the presence of a large quantity of radio-responsive crystals, such as zinc sulphide, applied and sometimes coated with a transparent adhesive or varnish. Such paints may be luminous for 10 years or longer. Other luminous paints are made from specially prepared impure sulphides of calcium, strontium, or barium. These paints, however, are luminous only under certain conditions and only for short periods immediately after exposure to sunlight. Luminous paints can not be made from phosphorus, and any attempt to do so is extremely dangerous.

CALCIMINE AND COLD-WATER PAINTS

As materials for making calcimine and cold-water paints are not always easy to buy and the ready-mixed paints are comparatively cheap, it is more satisfactory to buy them than to prepare them.

Calcimine and cold-water paints contain a lime compound (calcium carbonate or calcium sulphate) and an adhesive substance, which acts as a binder. In some cold-water paints the adhesive is casein, which is practically insoluble in water after the paint dries. Although coatings of such paints may be called "waterproof" in so far as they are not readily removed by water, they do not prevent moisture from reaching the surface beneath. When used out of doors they give little protection.

VARNISHES

Many of the varnishes sold by paint dealers are for special purposes. All-purpose or universal varnishes are the best unless the kind needed is known, but they often cost more than special varnish. As a rule, varnish intended for a particular purpose should be used for no other purpose. Varnishes of different kinds should not be mixed. They should be thinned as directed on their labels. Many varnishes will "liver," or become semisolid, when mixed with the common white pigments.

PAINT MIXED ON THE JOB

The chief advantage of paint mixed on the job over that bought ready mixed is its comparative cheapness. Before mixing is begun the quantity of paint needed should be estimated (p. 23) and all necessary materials and equipment obtained.

EQUIPMENT

All receptacles used in mixing paint must be clean, dry, and watertight.

The receptacle in which house paint is mixed should be large enough to hold all of the stock paint, that is, all the pigment and about half the linseed oil required to make it suitable for a finishing coat. Fifty-

pound lard cans or tubs or 300-pound white lead casks are usually big enough. Larger quantities of paint may be mixed in a wooden cask or half a vinegar barrel. A 100-pound white-lead keg is large enough for mixing a gallon or two. Before being used the cans or kegs should be thoroughly washed with hot soap solution or soda lye to remove all grease or dried white lead.

Containers with tight-fitting covers, like lard cans, which keep the contents clean and away from the air, are better than open cans or pails for storing paint after it has been mixed. Enough gallon cans, with air-tight compression tops, to hold all of the paint of each color are desirable.

Broad, flat paddles are convenient for handling the paste pigments and stirring the paint, and a paint-mixing machine is a great help when much painting is to be done. Cheesecloth or fine-mesh wire screen should be provided for straining the paint just before it is used.

A pint or quart container is needed for measuring linseed oil and volatile thinner, and a half-pint glass cup, marked off in fractions, is convenient for measuring small quantities of japan drier.

MIXING

In mixing white-lead paint, transfer the lead paste to the can or keg and measure into another container all the linseed oil that will be needed for the stock paint. Then begin to break down the lead paste by adding about half a pint of oil and working it in thoroughly with a paddle. Continue to add oil, a little at a time, mixing thoroughly with the paddle after each addition, until the paste is smooth and workable. Then work in the japan drier and turpentine in the same way, keeping the rest of the oil until after tinting.

In mixing a lead-and-zinc paint, measure the lead, zinc, and oil into separate containers. First break down the lead paste with part of the linseed oil, drier, and turpentine. Then break down the zinc paste in the same way. Mixing a little refined linseed oil or bodied linseed oil (about 1 pint for 50 pounds of zinc paste) with the raw linseed oil makes the operation easier. Add bodied linseed oil, if used, with the turpentine and drier, early in the breaking-down process. Finally add the zinc to the lead.

To make both a white and a tinted paint or two tinted paints, divide the partly thinned paste into two portions having the proper ratio. That is, if one part of trim color is needed for five parts of body color, put one-sixth of the paste in one container and five-sixths in another. Then tint one or both portions of the paste. After tinting, divide what is left of the linseed oil measured out for the stock paint into two parts having the same ratio as the divided paste and add each part to the corresponding portion of paste.

Stir each lot of stock paint thoroughly until the color and consistency are uniform. Mixing is hastened by "boxing," that is, pouring the paint back and forth from one container to another.

Finally strain each lot through wire fly screen or several thicknesses of cheesecloth and keep it in tightly-covered containers. This stock paint should stand for at least a day, after which it should be thinned before it is applied to any surface. Skin or coarse particles should always be removed by straining the paint.

TINTING

One or more tinting pigments may be added to the stock paint. The quantity required depends on the tinting power of the pigment and the depth of color desired (p. 26).

Break down or thin the paste color with linseed oil or turpentine before adding it to the white base. Mixing can be done best while the white base is still a heavy paste. Add only a little color at a time, stirring it in thoroughly before adding any more. If more than one color is used, it is better to make small additions of each in turn than to complete the addition of one before starting with another. Often the desired color is obtained before all the tinting material prepared has been used. The tint will be somewhat lighter when the paint is thinned for use.

OUTSIDE HOUSE PAINT

WHITE-LEAD PAINT

Stock paint (to make 7 gallons of paint when thinned)

White-lead paste	pounds	100
Raw linseed oil	gallons	2
Japan drier	pint	1
Turpentine	pint	1

After mixing (p.13), divide according to the number and quantity of colors needed and tint before thinning.

Paint for a three-coat job.—Divide the stock paint of each color into three equal parts. If the trim color is to be used only for second and third coats, divide and thin the stock paint for trim as described for a two-coat job. Thin the first part with three-fifths its volume of a mixture of linseed oil and turpentine in equal parts. Thin the second part with three-tenths its volume of turpentine. Thin the third part with three-tenths its volume of linseed oil.

Paint for a two-coat job.—Divide the stock paint of each color into two equal parts. Thin the first part with two-fifths its volume of turpentine. Thin the second part with two-fifths its volume of linseed oil.

LEAD-AND-ZINC PAINT

Stock paint A (to make 6 gallons of paint when thinned)

White-lead paste	pounds	50
Zinc-oxide paste	pounds	25
Raw linseed oil	gallons	2⅛
Japan drier	pint	1
Turpentine	pint	1

Stock paint B (to make 5 gallons of paint when thinned)

White-lead paste	pounds	50
Zinc-oxide paste	pounds	12½
Raw linseed oil	gallons	1⅞
Japan drier	pint	¾
Turpentine	pint	¾

To make a white paint, use refined linseed oil, which has been specially treated to lighten the color, instead of the raw oil, and pale japan instead of the ordinary dark drier.

After mixing, divide the stock paint (A or B) according to the number and quantity of colors needed and tint.

Paint for a three-coat job.—Divide the stock paint of each color into three equal parts. Thin the first part with two-fifths its volume of a mixture of linseed oil and turpentine in equal parts. Thin the second part with one-fifth its volume of turpentine. Thin the third part with one-fifth its volume of linseed oil.

Paint for a two-coat job.—Divide the stock paint of each color into two equal parts. Thin the first part with one-fourth its volume of turpentine. Thin the second part with one-fourth its volume of linseed oil.

SPECIAL THINNING

Conditions sometimes make it necessary to change the proportions of linseed oil and turpentine for thinning paints made according to the foregoing directions. When special thinning is required, add the oil or turpentine, a little at a time, to the stock paint and stir well after each addition. When the paint seems to be thin enough make a brushing test on the surface to be painted.

First-coat paint for unpainted wood should contain enough turpentine to make the oil strike in well and enough linseed oil to satisfy the absorption of the wood. On resinous wood like yellow pine, which is not very absorbent, the proportion of turpentine in first-coat paint should be increased and the proportion of linseed oil decreased. The priming coat for cypress should be thinned with benzol. The first coat should color the wood fairly well, but should not hide the surface completely. It should dry flat, that is, with no gloss. If it dries with a gloss, too much oil has been added.

The second coat for new wood should brush out easily, but it should almost entirely hide the surface. It should dry flat or with very little gloss. If too much thinner is used, the second coat will be too transparent. If too much oil is added, the paint will be glossy when dry, making an unsatisfactory foundation for the finishing coat.

The final coat should not be too thick; neither should it be thinned so much that it fails to hide the surface. Since the final coat must dry with a full gloss to be weather resistant, no turpentine or other volatile liquid should be added to that already in the stock paint. Only linseed oil should be used for further thinning.

In repainting badly weather beaten surfaces, it may be neccssary to add to the first-coat paint more oil than is usually required in a two-coat job. Such surfaces need three coats.

INTERIOR PAINT

FLAT-FINISH PAINT

Since flat-finish paints are thinned principally with volatile liquids, which permit the pigments to settle rapidly and which evaporate on exposure, each lot of paint should be prepared as it is needed. If more than one color is necessary, divide the base pigment after it has been brought to a smooth working condition and tint before more thinner is added.

Priming coat on unpainted plaster (2½ gallons)

White-lead paste	pounds	25
Raw linseed oil	gallons	1¾
Japan drier	pint	¾
Turpentine	pints	2

If kettle-boiled linseed oil is available, use it instead of raw linseed oil, and substitute additional turpentine for japan drier.

This paint is designed to fill the pores and fine cracks in unpainted plaster. It is best to follow it with good varnish size (p. 23).

First coat over priming coat, old paint, or wall size (1½ gallons)

White-lead paste	pounds	25
Raw linseed oil	pints	3
Turpentine	pints	3
Japan drier	pint	¼

This paint may be used as the first coat of a two-coat job on surfaces which have been painted or sized, or as the second coat of a three-coat job.

Finishing coat (1½ gallons)

White-lead paste	pounds	25
Flatting oil	gallon	½ to ¾

If flatting oil is not available, use 3 to 5 pints of turpentine, adding one-eighth pint of japan drier.

This paint is suitable for finishing coats when a flat finish is desired and for undercoats before enameling. The smaller quantity of thinner is sufficient for a finishing coat over only one coat of paint or for an undercoat for enamels where not more than two undercoats are desired.

GLOSS-FINISH PAINT

To make a colored paint with an oil gloss, mix according to formulas for outside house paint (p. 14). White paints having linseed oil as the principal vehicle are not suitable for interiors because they become yellow when shaded from sunlight. To obtain a high-gloss finish suitable for kitchens and bathrooms use a good enamel paint. It is not usually practicable to mix enamels on the job.

BARN PAINT

BARN PAINT NO. 1 (5½ GALLONS)

Metallic oxide ground in linseed oil	pounds	50
Raw linseed oil	gallons	2½
Japan drier	pints	1½

BARN PAINT NO. 2 (7 GALLONS)

Metallic oxide, dry	pounds	50
Raw linseed oil	gallons	5½
Japan drier	pints	2

Allow the paint to stand for a day or longer. When ready to apply, stir it thoroughly; also stir occasionally while painting. Paint made in this way is suitable for surfaces that have been painted and are not porous and weather beaten. For priming new wood or for a

first coat on painted wood that has become porous, thin the paint with linseed oil and turpentine (or mineral spirits), mixed in equal parts. Paint prepared from dry pigment costs less than that prepared from paste, but it is more difficult to mix, settles out more rapidly, and is not as smooth and uniform.

PAINT FOR BRICK AND CONCRETE

At least three coats should be applied to unpainted brickwork. Best results are obtained if the first coat is mixed with kettle-boiled linseed oil (p. 6). It is well to apply three coats to soft brick surfaces before putting on the finishing coat. The third coat should be like the second.

LIGHT PAINT

Light-colored paints for brick or concrete may be made according to the following formulas, adding lampblack, raw sienna, and French ocher to get tints of gray, cream, or buff.

First coat (about 10½ gallons)

White lead in oil	pounds	100
Raw linseed oil	gallons	6½
Japan drier	pints	2
Turpentine	gallon	1

If kettle-boiled linseed oil is available, use it instead, omitting the japan drier.

Second coat (about 7½ gallons)

White lead in oil	pounds	100
Color in oil		As required.
Raw linseed oil	gallons	4½
Japan drier	pints	1½
Turpentine	pint	1

If kettle-boiled linseed oil is available, use 1 part of it to 2 parts of raw oil, and reduce the quantity of drier to 1 pint.

Finishing coat, flat (about 6 gallons)

White lead in oil	pounds	100
Color in oil		As required.
Flatting oil	gallons	3
Japan drier	pint	½

If flatting oil is not available, use about 2¼ gallons of turpentine.

Finishing coat, semiflat (about 6 gallons)

White lead in oil	pounds	100
Color in oil		As required.
Raw linseed oil	gallon	1
Turpentine	gallons	2
Japan drier	pint	½

RED PAINT

Red paint for bricks may be made according to the following directions, varying the proportions of red and yellow pigments as desired.

First coat (about 9 gallons)

Venetian red in oil	pounds	25
Yellow ocher in oil	pounds	25
Raw linseed oil	gallons	5
Japan drier	pints	2
Turpentine	gallon	¾

If kettle-boiled linseed oil is available, use it instead of raw linseed oil, omitting the japan drier.

Second coat (about 6¼ gallons)

Venetian red in oil	pounds	25
Yellow ocher in oil	pounds	25
Raw linseed oil	gallons	3
Japan drier	pints	1½
Turpentine	pint	1

If kettle-boiled linseed oil is available, use 1 gallon of it to 2 gallons of raw oil and reduce the quantity of drier to 1 pint.

Finishing coat (about 5¼ gallons)

Venetian red in oil	pounds	25
Yellow ocher in oil	pounds	25
Flatting oil	gallons	2
Japan drier	pint	½

If flatting oil is not available, use about 1½ gallons of turpentine.

OUTSIDE PAINT FOR METALS

Good paints for metal surfaces may be prepared by mixing red lead (p. 5) or sublimed blue lead (p. 5) ground in oil with linseed oil and drier according to directions on the kegs in which the pigments are sold. Paint from dry red lead should be mixed in the following proportions just before it is used:

Red lead, dry	pounds	50
Raw linseed oil	gallons	1¾
Oil drier	pint	1

This will make 2½ gallons of red lead paint.

To make a cheaper paint, mix red or brown metallic pigment, linseed oil, and drier according to the directions for barn paint given on page 16.

The finishing coats for oil tanks and other structures which need protection from the sun's heat should be white or light colored. They may be mixed like outside house paints (p. 14). Aluminum paint may be prepared by mixing aluminum bronzing powder, preferably polished, with good outside spar varnish in the proportion of 2 pounds to the gallon. Add the varnish to the dry pigment, a little at a time, stirring well after each addition.

FARM IMPLEMENT PAINT

Paint for farm machinery and implements should dry harder and give a more water-resistant coat than the ordinary house paints. Pigments ground in japan or coach-painters' colors, mixed with varnish and thinner, are better than the ordinary paste pigments mixed with linseed oil alone.

The pigment may be a single color or a mixture of colors. Indian red, drop black, light chrome green, and medium chrome yellow are good pigments for self colors. Zinc white, or a mixture of white lead and zinc containing at least one-half zinc, is a suitable base for grays and other light tints. Before proceeding with the mixing, it is advisable to mix small quantities of the pigment and vehicle to see if mixing can be accomplished without livering. It may be necessary to change either the pigment or the vehicle.

FARM IMPLEMENT PAINT NO. 1

First coat (¾ to ⅞ gallon)

Pigment ground in japan	pounds	5
Outside spar varnish	pint	1
Turpentine	pints	3

Second coat (¾ to ⅞ gallon)

Pigment ground in japan	pounds	5
Outside spar varnish	pints	3
Turpentine	pint	1

FARM IMPLEMENT PAINT NO. 2

First coat (⅝ to ¾ gallon)

Pigment ground in linseed oil	pounds	5
Coach painters' japan[4]	pint	1
Turpentine	pints	2

Second coat (⅝ to ¾ gallon)

Pigment ground in linseed oil	pounds	5
Coach painters' japan[4]	pints	2
Turpentine	pint	1

Paint made by these formulas may be used for repainting implements and machinery while the original paint is still in place. Parts that are entirely free from paint should have three coats.

Red lead or sublimed blue lead, mixed with a little linseed oil, japan drier, and enough turpentine to dry flat, is good for priming metal and, with a somewhat higher proportion of linseed oil, can also be used for priming wood. These pigments, mixed with linseed oil and japan drier, may be used for finishing coats. In the absence of such paints, the uncoated metal parts can be primed with the first-coat paints in formulas 1 and 2, using a little more turpentine, and the wood can be primed with white lead and zinc oxide, tinted as desired, or with any other pigment, mixed with a little linseed oil, japan drier, and enough turpentine to dry flat. The addition of litharge (about 15 per cent of total pigment) is advisable.

SHINGLE STAINS

To make creosote stains, thin pigments ground in linseed oil with a vehicle consisting of 2 volumes of raw linseed oil, 2 volumes of turpentine or mineral spirits, 2 volumes of coal-tar creosote, and 1 volume of brown japan drier.

[4] Not ordinary japan drier, but a hard-drying varnish, heavily charged with drying compounds, which can be used in any proportion with linseed oil.

For a dark-brown stain, add either burnt umber or Indian red, darkened with lampblack. For a green stain, add pure medium chrome green, modified with chrome yellow, yellow ocher, raw sienna, or lampblack. The quantity of pigment needed varies with the color. Ten gallons of a dark-brown stain from Indian red and lampblack calls for about 50 pounds of red pigment and 5 pounds of lampblack, with 7 gallons of the mixed vehicle. Twenty pounds of chrome green with 7 gallons of vehicle will yield about 8 gallons of stain.

Shingle stains can also be prepared from dry pigments, but the mixing is more difficult, and the pigments, being less finely ground, are more likely to settle, producing mottled or streaky effects.

WHITEWASH

COMMON WHITEWASH

Slake fresh quicklime of good quality with clean water, added a little at a time, in a clean wooden pail, keg, or barrel. Slaking may be hastened by breaking up some of the lumps or by adding a little hot water. When slaking is well started, add more water gradually to replace that lost in the slaking process. If not enough water is used the lime will become "scorched," and part of it will be granular. On the other hand, too much water may retard or "quench" the slaking process. After the lime is completely slaked, add enough water to make a thick paste, cover the container with boards to keep in the heat, and let it stand for several hours or over night. Then strain the paste through wire fly screen, and thin it to brushing consistency with clean water.

Whitewash can be more easily prepared by simply adding water to hydrated lime that has been well protected from the air. Hydrated lime, however, is not always available.

SPECIAL WHITEWASHES[5]

Whitewash No. 1 (for sheds, etc.).—Carefully slake half a bushel (38 pounds) of good quicklime; strain the paste, while still thick, through wire fly screen and add it to a solution made by dissolving 15 pounds of common salt in 7½ gallons of water, mixing thoroughly. Thin with more water.

Whitewash No. 2 (for sheds, etc.).—Carefully slake half a bushel (38 pounds) of good quicklime; strain the paste, while still thick, through wire fly screen and add about 4 gallons of hot water. While stirring vigorously pour into the lime mixture a solution made by first dissolving 12 pounds of salt and 6 ounces of alum in about 4 gallons of hot water and then adding 1 quart of molasses. Thin with water.

Whitewash No. 3 (for high-grade work).—(*a*) Carefully slake half a bushel (38 pounds) of good quicklime; strain the paste, while still thick, through wire fly screen, add about 4 gallons of water, and allow to cool. (*b*) Dissolve 3 pounds of borax (better trisodium phosphate) in about 3 gallons of skimmed milk (better in 1 gallon of water, which is afterwards added to 5 pounds of casein previously softened for 2 hours in 2 gallons of hot water). (*c*) Dissolve 3 pints of formaldehyde in about 3 gallons of water.

[5] Based on formulas in National Lime Association Bulletin 304-B, "Whitewash and Cold Water Paint."

When the lime paste (*a*) and the milk (or casein solution) (*b*) are thoroughly cool, slowly add the milk (or casein solution) (*b*) to the lime (*a*), stirring constantly. Just before using, slowly add the formaldehyde solution (*c*) to the batch, stirring constantly and vigorously. Adding the formaldehyde too rapidly may cause the casein to jelly, thus spoiling the mixture.

Caution.—If all of this mixture can not be used in one day, use only half, or a third, or other fractional part of each of the three parts (*a*, *b*, and *c*), and mix the rest as required.

In all of these directions, one sack (50 pounds) of hydrated lime, which has been well protected from the air, can be used in place of the freshly slaked lime. In No. 1 the hydrated lime can be added directly to the salt solution; in Nos. 2 and 3 it should first be made into a paste by mixing it thoroughly with about 7 gallons of water.

Whitewash No. 4 (disinfectant whitewash).—For a mild disinfectant or insecticidal whitewash, add a quart of crude carbolic acid to the whitewash obtained by slaking half a bushel (38 pounds) of quicklime or by mixing a sack (50 pounds) of good hydrated lime with water.

For a strong germicidal whitewash, add 2 quarts of crude carbolic acid to the whitewash.

Whitewash No. 5 (disinfectant whitewash, small quantity).—Dilute 1½ quarts of commercial lime-sulphur with about 3 gallons of water and add 3 tablespoonfuls of common salt, previously dissolved in a pint of water. To this solution add, while stirring constantly, a lime cream made by mixing a heaping quart of good hydrated lime with water (or by slaking about 2½ pounds of fresh quicklime and straining through wire fly screen).

HOW TO PREPARE SURFACES FOR PAINTING

WOOD

New unpainted wood usually needs very little preparation. Dusting off loose dirt, removing mortar, plaster, or cement with a scraper or sandpaper, and filling nail holes and loose joints with putty after the priming coat is dry may be sufficient. If the wood is resinous or waxy or contains knots and coarse grain figures full of rosin or pitch, however, special treatment is necessary. Charring with a blowtorch will kill the pitch in knots, but the usual method is to apply a thin coat of orange shellac to all pitchy places before the surface is painted. Resinous wood like yellow pine should be brushed over with turpentine just before it is painted; cypress should be brushed over with solvent naphtha or benzol.

A painted surface that is simply chalky needs only to be dusted. All paint that has begun to scale or peel must be removed by scraping or brushing with a wire brush; more adherent paint that is checked may be softened with a blowtorch and then scraped off. All loose putty should be removed from nail holes, joints, and cracks, and fresh putty put in after the first coat of paint has dried.

Surfaces that have been varnished or enameled should be rubbed with fine sandpaper, curled horsehair, or fine steel wool until the gloss is removed. If such surfaces are marred, prepared varnish remover should be used,[6] smoothing the wood after it is dry with steel wool

[6] U. S. Dept. Agr., Farmers' Bul. 1219 gives further details for this work.

or sandpaper. Painted or varnished woodwork in kitchens and bathrooms should be washed with soap and water and then thoroughly sponged with clean water. Floors that have been treated with nonvolatile mineral oils can not be painted or varnished.

Shingles or other wooden surfaces that have been treated with creosote or creosote stains cannot be painted until they have weathered for several years.

Wood that has been whitewashed can not be painted until the whitewash has been removed as completely as possible.

Surfaces that have been coated with tar or other bituminous materials should be coated with shellac varnish before they are painted with oil paints. If soft, such surfaces should be coated with sand before they are painted or whitewashed.

BRICK AND CONCRETE

Old paint on brick surfaces is frequently loose, so that the surface must be gone over carefully and all paint which is not firmly attached to the surface scraped off. Before painting very porous bricks or similar materials which have never been painted, it is best to apply kettle-boiled linseed oil and oil drier or a special undercoater for sealing the pores of outside surfaces. A solution containing from 2 to 4 pounds of zinc sulphate to the gallon of water, carbonated ("soda") water, or ammonium carbonate solution should be applied to concrete, cement, stucco, mortar, and plaster made with lime, to neutralize free alkali, unless the surface has been exposed to the air for at least a year.

PLASTER

Wall paper should be removed from any plastered surface to be painted. Cracks and holes should be cut out so that they are wider on the inside than at the surface. Their edges should then be wet, and they should be filled with plaster of Paris or a mixture of plaster of Paris and whiting, adding sand for the rough first filling. When dry, patches in plaster which has been coated with oil paint should be covered first with thin shellac and then with one or two coats of flat oil paint before the entire surface is repainted.

Before either oil or water paints are applied to plastered surfaces, all old coats of calcimine, cold-water paint, or whitewash must be washed off as thoroughly as possible.

Wall-paper stains can usually be removed by washing walls with soda solution and sponging with clean warm water. All stains remaining after the walls are dry should be coated with shellac, varnish, or aluminum paint mixed with banana oil.

Unless the surface has been coated with oil paint or sized with a material insoluble in water, a preliminary sizing coat is necessary before calcimine or cold-water paint is applied. To make glue sizing, soak granulated glue in water for several hours, then heat it to boiling while stirring, and add enough water to make a thin sticky solution. Sometimes gloss oil, hard oil, or suction varnish is used on perfectly dry walls. Calcimine is said to give best results when applied to walls that have had a coat of flat or semigloss oil paint.

Before painting with oil paints plaster less than a year old and not previously coated with oil paint, it is best to apply a solution of zinc sulphate, ammonium carbonate, or carbonated water. Smooth hard-

finish plaster should be coated with a good flat-finish varnish size. A little wall paint should be added if the paint and varnish will mix without livering. A coat of thick paint should be rubbed well into all fine cracks in the plaster and allowed to dry before the varnish sizing is applied. Varnish solutions for sizing walls are sold, but any good interior varnish that can be so thinned with turpentine or mineral spirits that it will dry flat will serve the purpose. Gloss oil and other cheap rosin varnishes, used under oil paints, may retard or prevent drying. Glue-and-oil size or glue size should be used on rough or sand-finish plaster.

Loose dust and dirt must be removed from plaster that has been coated with oil paint, and all defects in the surface remedied. The walls and ceilings in kitchens and bathrooms should be washed with soap and water and sponged off with clean water.

All gloss from enamel or ordinary house paints should be removed with sandpaper or steel wool.

METAL

Wire brushes, sandpaper, steel wool, scrapers, or a hammer and chisel may be used to remove rust and scale from metal surfaces. If metal roofing, guttering, or drain spouting is too badly rusted to be cleaned without making holes in it, the defective metal should be replaced. All rosin or other flux should be completely removed from the soldered seams of new metal. Deep rust spots on heavy metal not in contact with wood may be heated thoroughly with the flame of a blowtorch to remove all moisture. No loose paint or dirt should be left on the surfaces.

Some parts of implements and machines are usually coated with oil or grease, and new tinned and galvanized iron always has a thin film on the surface as a result of the manufacturing processes. All oil or grease should be removed with gasoline, mineral spirits, or other suitable solvent before the metal is painted.

Unless it has been exposed to the weather for a year or more, galvanized iron needs special treatment to roughen the surface slightly so that the paint will have a foothold. Strong vinegar or dilute hydrochloric (muriatic) acid, sometimes used to give such surfaces a "tooth," may attack the zinc coating too vigorously. A strong water solution of copper sulphate (bluestone), ammonium chloride (sal ammoniac), or ammonium phosphate is better than acid. Or a special undercoater, consisting of a thin, elastic flat varnish containing silica or siliceous material in suspension, may be applied to give the surface a "tooth."

HOW TO ESTIMATE THE QUANTITY OF PAINT NEEDED

To estimate the quantity of liquid coating needed, it is necessary to know the size of the surface to be covered and the spreading rate of the material to be applied.

SURFACE AREA OF BUILDINGS

The surface area is calculated in square feet from the dimensions in feet of the surface to be painted. Measurements which can not conveniently be made can usually be guessed with sufficient accuracy.

It is best to draw a diagram of each surface and mark on it the dimensions in the nearest number of feet. Such diagrams will usually be in the form of a parallelogram (a four-sided figure with opposite sides parallel), a trapezoid (a four-sided figure with only one pair of opposite sides parallel), or a triangle (a three-sided figure), or they may be divided into such figures. Calculate the area as follows, and add the results: *Parallelogram*, multiply the base by the altitude (perpendicular height); *trapezoid*, multiply half the sum of the two parallel sides by the perpendicular distance between them; *triangle*, multiply the base by half the altitude (perpendicular height).

SPREADING RATES

The following estimates for the quantity of coating materials needed for different surfaces are only approximate for average conditions. The figures for outside oil paints are based on 1 gallon having the consistency of ready-mixed paint or paint mixed for the finishing coat. This volume will, of course, be increased for priming and for second coats in three-coat work by adding linseed oil or a mixture of linseed oil and turpentine.

Coating material	Character of surface	Surface covered by 1 gallon		
		1 coat	2 coats	3 coats
		Sq. ft.	*Sq. ft.*	*Sq. ft.*
Oil paint (gloss finish)	Smooth wood	600	325	225
	Rough wood	350	200	135
	Metal	700	340	230
	Plaster	450	250	175
	Hard brick	400	225	160
	Soft brick	350	200	150
	Smooth cement	350	200	150
	Rough cement (stucco)	200	100	------
Oil paint (flat finish)	Smooth wood or wallboard	500	275	200
	Plaster	400	225	160
	Hard brick	350	200	150
	Soft brick	300	175	125
	Smooth cement	300	175	125
	Rough cement (stucco)	150	75	------
Enamel paint	Smooth, painted with undercoats	500	250	------
Exterior spar varnish	Smooth wood	500	275	200
Interior finishing varnish	Smooth wood	450	250	175
Shellac	Smooth wood	600	360	------
Shingle stain [1]	Rough wood	125	75	------
Asphalt roof paint	Smooth	250	------	------
	Rough	150	------	------
Asphalt-asbestos liquid roof cement	Smooth	100	------	------
Cold-water paint (5 pounds powder)	Smooth	300	------	------
Calcimine (5 pounds powder)	Plaster	400	------	------
Whitewash (4 to 5 pounds hydrated lime)	Wood	250	------	------
	Brick	200	------	------
	Plaster	300	------	------

[1] 2½ gallons per 1,000 shingles when dipped two-thirds their length.

ESTIMATING REQUIREMENTS

Divide the number of square feet of surface by the spreading rate of the liquid for the kind of surface to be coated and the number of coats to be applied.

It is not necessary to make as careful estimates for ready-mixed paints as for paint mixed on the job. For a two-coat repainting job on a house of moderate size and in good condition, it is fairly safe to get as many gallons of paint as there are rooms in the house. For a three-coat job about half again as many gallons may be required.

Ready-mixed paints are just about right for the final coat. They need to be thinned for the first coat and usually in three-coat work for the second coat. Ordinarily for a three-coat job two-thirds pint of turpentine and 2⅔ pints of linseed oil for every gallon of paint bought will be enough. For a three-coat job on new resinous wood, like yellow pine or cypress, provide about 1½ pints of turpentine and 1 pint of linseed oil for every gallon of paint. For repainting surfaces in fair condition with two coats, about half a pint of turpentine and 1 pint of linseed oil for every gallon of paint will be needed.

When the paint is to be mixed on the job from paste pigments, linseed oil, turpentine, and drier, the approximate quantities needed for each gallon of paint will be in the following proportions:

All-lead paint (p. 14)

White-lead paste	pounds	14½
Raw linseed oil	pints	3½
Turpentine	pints	1¼
Japan drier	pint	⅛

1 pound of zinc paste to 2 pounds of lead paste (p. 14)

White lead in oil	pounds	8⅛
Zinc oxide in oil	pounds	4⅛
Raw linseed oil	pints	3⅔
Turpentine	pint	1
Japan drier	pint	⅛

1 pound of zinc paste to 4 pounds of lead paste (p. 14)

White lead in oil	pounds	10
Zinc oxide in oil	pounds	2½
Raw linseed oil	pints	3¾
Turpentine	pint	1
Japan drier	pint	⅛

One hundred pounds of white-lead paste will make about 7 gallons of paint, which is the average quantity needed for a two-coat repainting job on a six or seven room house. Mixed in the same proportions, 50 pounds will make 3½ gallons; 25 pounds, 1¾ gallons; and 12½ pounds, seven-eighths gallon.

One hundred pounds of white-lead paste with 50 pounds of zinc-oxide paste will make about 12 gallons of paint, and with 25 pounds of zinc oxide, about 10 gallons of paint. Smaller quantities of pigments mixed in the same proportions will give corresponding quantities of paint.

For tinted paints a small quantity of tinting color ground in linseed oil will also be needed. For every hundred pounds of lead probably less than a pound of Prussian blue or lampblack would be required. From 1 to 2 pounds of raw umber, burnt umber, raw sienna, burnt sienna, chrome yellow, chrome green, Indian red, or Venetian red would be needed for light tints and possibly 5 pounds for darker tints. From 3 to 5 pounds of French ocher for light tints and from 10 to 15 pounds for darker tints may be required.

The approximate proportions of some of the more common pigments, in unreduced[7] paste form, to make various colors are as follows:

[7] If reduced pigments are used, larger quantities will be required.

Blue (sky).—White lead, 100 pounds; Prussian blue, one-half pound.

Browns.—*Bismark brown*: Burnt sienna, 100 pounds; burnt umber, 25 pounds; white lead, 10 pounds; orange chrome yellow, 5 pounds. *Chocolate (dark)*: French ocher, 100 pounds; Indian red, 20 pounds; lampblack, 10 pounds. *Seal brown*: Burnt umber, 100 pounds; French ocher, 80 pounds; white lead, 25 pounds.

Brownstone.—White lead, 100 pounds; Venetian red, 7½ pounds; medium chrome yellow, 2½ pounds; lampblack, 1 pound.

Buff.—White lead, 100 pounds; French ocher, 10 pounds.

Clay.—White lead, 100 pounds; French ocher, 15 pounds; Venetian red, three-fourths pound; lampblack, 1 ounce.

Creams.—*Cream tint*: White lead, 100 pounds; French ocher, 1 pound; lemon chrome yellow, one-half pound. *Deep cream*: White lead, 100 pounds; raw sienna, 1 pound; French ocher, one-half pound.

Dove.—White lead, 100 pounds; Indian red, one-half pound; Prussian blue, 2 ounces; lampblack, 1 ounce.

Drabs.—*Olive drab*: White lead, 100 pounds; raw umber, 30 pounds; medium chrome green, 2½ pounds. *Warm drab*: White lead, 100 pounds; French ocher, 10 pounds; lampblack, 1 pound; Venetian red, one-half pound.

Ecru.—White lead, 100 pounds; French ocher, 2 pounds; burnt sienna, one-fourth pound; lampblack, 1 ounce.

Fawn.—White lead, 100 pounds; French ocher, 7½ pounds; burnt umber, 1½ pounds.

Grays.—*Ash gray*: White lead, 100 pounds; French ocher, 1 pound; lampblack, 2 ounces. *French gray*: White lead, 100 pounds; drop black, 1 pound; carmine lake, 1 ounce; Prussian blue, a trace. *Lavender gray*: White lead, 100 pounds; drop black, three-fourths pound; Indian red, one-fourth pound. *Pearl gray*: White lead, 100 pounds; drop black, three-fourths pound; Indian red, 1 ounce. *Silver gray:* White lead, 100 pounds; French ocher, 1 pound; lampblack, one-fourth pound. *Smoke gray:* White lead, 100 pounds; French ocher, 2½ pounds; lampblack, one-fourth pound.

Greens.—*Apple green:* White lead, 100 pounds; medium chrome green, 2½ pounds; medium chrome yellow, 2½ pounds; lampblack, 2 ounces. *Moss green:* White lead, 100 pounds; medium chrome green, 15 pounds; medium chrome yellow, 30 pounds; lampblack, 5 pounds. *Olive green*: White lead, 100 pounds; medium chrome yellow, 10 pounds; lampblack, 2 pounds; medium chrome green, 1 pound. *Sage green*: White lead, 100 pounds; medium chrome green, 5 pounds; raw umber, 5 pounds.

Ivory.—White lead, 100 pounds; raw sienna, one-fourth pound; lemon chrome yellow, 2 ounces.

Lead.—White lead, 100 pounds; lampblack, 2 pounds.

Lilac.—White lead, 100 pounds; Venetian red, one-half pound; lampblack, 2 ounces.

Reds.—*Brick red:* Venetian red, 100 pounds; yellow ocher, 80 pounds. *Indian red:* Indian red, straight. *Maroon:* Tuscan red, 100 pounds; lampblack, 2 pounds. *Tuscan red:* Tuscan red, straight.

Salmon.—White lead, 100 pounds; French ocher, 10 pounds; Venetian red, 5 pounds; medium chrome yellow, 2½ pounds.

Sandstone.—White lead, 100 pounds; medium chrome yellow, 3 pounds; burnt umber, 2½ pounds; Venetian red, 2 ounces.

Tan (light).—White lead, 100 pounds; French ocher, 5 pounds; raw sienna, 2 pounds; Venetian red, 2 ounces.

Terra cotta.—White lead, 100 pounds; burnt sienna, 20 pounds.

Yellows.—*Canary (pale):* White lead, 100 pounds; lemon chrome yellow, 1 pound; French ocher, one-half pound. *Colonial yellow:* White lead, 100 pounds; French ocher, 3 pounds; lemon chrome yellow, 2 pounds. *Straw:* White lead, 100 pounds; French ocher, 7½ pounds; medium chrome yellow, 3 pounds.

HOW TO PAINT

Paint must thoroughly wet the surface to which it is applied, and the combined thickness of all the coats should be just sufficient to hide the surface. In outside painting two or three thin coats are better than one thick coat.

The extent and character of the surface and the kind of coating material used will determine the best way of painting. The usual way

is by brushing. Shingle stains are often applied by dipping. Spraying is sometimes satisfactory for coating large smooth surfaces with materials especially adapted for the purpose.

BRUSH PAINTING

BRUSHES

Good tools, as well as good paint, are essential for a good painting job. Only good brushes, of the right size and construction for the work in hand, should be bought. The horsehair and vegetable fiber sometimes found in cheap brushes are poor substitutes for the bristles in the more expensive brushes.

A 4-inch flat brush is generally used for applying oil paints to large surfaces, but 3½-inch brushes are probably better for beginners. The bristles in 4-inch flat brushes should not be more than 4¼ inches long, except for experienced painters. For trimming and small surfaces, a flat brush, 2 to 2½ inches wide, with bristles 3 to 3¼ inches long, is suitable. A flat or oval sash brush, 1 to 1½ inches wide, with bristles about 2 inches long, is also necessary. A special penciling brush, the smallest oval sash brush, or a round lettering brush is needed for penciling brickwork. For varnishing there should be a special varnish brush, which has never been dipped in paint. On moldings, pipes, railings, and other surfaces which are not flat, oval brushes will probably be better than flat brushes.

A painters' dusting brush is convenient for removing loose dirt and dust. Calcimine brushes, wall-stippling brushes, roof-painting brushes, whitewash brushes, soft brushes for fine varnish and enamel work, and other special brushes are also needed at times.

For painting rough surfaces, which are very hard on brushes, old stubby brushes can be used. For applying shingle stain a cheap brush is as good as an expensive one.

Paint should never be allowed to dry on a brush. Nor is it advisable to keep paint brushes in water. When outside painting stops for more than an hour, the brushes should be kept in raw linseed oil. When painting is again resumed, as much oil as possible should be scraped or wiped from the brushes, after which the remainder should be thoroughly mixed with the paint by repeatedly filling the brush and scraping it against the inner edge of the paint pot. Brushes that have been used in flat-finish paints and are to be used again soon for the same purpose should be kept in kerosene during the interval. Before being used again, most of the kerosene should be wiped from the brush, and that remaining should be thoroughly mixed with the paint.

During long intervals between painting jobs, even if it is for several years, the most satisfactory method for keeping paint brushes in good condition is to hang them in raw linseed oil, preferably in closed containers. Each brush should have a hole bored through the handle, so that it can be slipped over the lower end of a double wire hook of such length that the bristles will be completely covered by the oil. Placing brushes in linseed oil or other liquids without support bends the bristles out of shape. The fresh paint remaining in a brush when it is ready to be stored need not be removed before the brush is placed in raw oil. The pigment, loosened by the oil during storage, will gradually settle out. A skin will form on the surface, but the oil

below will keep the bristles soft. Any skin clinging to the metal or wooden parts of the brush can be easily scraped off. Fresh paint can also be removed from a brush by washing it first in turpentine, kerosene, or mineral spirits and then with soap and water, after which the bristles should be dried thoroughly and covered with wrapping paper.

After use varnish brushes should always be thoroughly washed, preferably in turpentine, although benzol or coal-tar naphtha will do. Brushes that have been in shellac or other spirit varnish should be cleaned with denatured alcohol. During all interruptions in the work brushes should be kept either in turpentine or in the varnish, with the bristles completely covered by the liquid, and the container should be kept closed. Clean varnish brushes may either be wrapped in paper and laid away or they may be hung in raw linseed oil, not, however, in the container used for paint brushes. Varnish brushes that have been kept in oil must be washed free of the oil, preferably with turpentine, before being used.

It is best to clean roof brushes thoroughly and store them dry, with no weight resting on the bristles. Brushes that have been used with oil or asphalt paints can be cleaned with turpentine or gasoline. Those that have been used with coal-tar paints can be cleaned with benzol or solvent naphtha.

Whitewash and calcimine brushes should be washed thoroughly in water after each day's work and hung up to dry, with the bristles down. They should not be put in whitewash or cold-water paint until the lime has thoroughly slaked and the liquid has cooled. Soaking for an hour or two before use swells and tightens a dry whitewash brush which loses its bristles.

Oil paints and varnishes containing much linseed oil can not be successfully removed after they have dried on a brush. Certain treatments will soften the hardened material to some extent, but the bristles must be scraped to clean them thoroughly. Sometimes the bristles can be separated by soaking the brush in raw linseed oil for a day or two and then washing with hot turpentine. Soaking a brush for 12 to 24 hours in a warm solution containing a pound of sal soda in 3 pints of water frequently softens it so that it may be washed with soap and water. Some painters believe that a mixture of soda ash or sal soda with borax or trisodium phosphate is less harmful. Lye or caustic soda ruins the bristles.

APPLYING THE PAINT

Hold the brush lightly but firmly, with the narrow part of the handle between the thumb and first two fingers, much as a pencil is held in drawing lines with a rule, and use it in such a way that it wears down uniformly and keeps its original shape. Do not grip a brush by the stock, with some of the fingers extending over the bristles, and do not bear down too hard on it. Use a moderate, even pressure in spreading the paint and a light, even pressure in finishing. The muscles of the wrist, which do most of the work, can be relieved by using also the muscles of the arm and even those of the shoulder. While the brush is being drawn back and forth across the surface do not let the hand lead, but keep it directly over the brush. Lift the brush from the surface before starting a return stroke. Poking or jabbing the brush into corners or cracks ruins the bristles.

Do not dip the brush too deep into the paint. One-third the length of its bristles is far enough. After dipping, tap the brush gently against the edge of the paint pot or draw it lightly across the inner edge to remove the excess paint. Use all of each brushful before dipping again. In painting overhead carry less than the usual quantity of paint in the brush.

Wipe immediately, with a clean dry cloth, surfaces that have been accidentally soiled with paint.

In painting outside surfaces start at the top and move downward. It is customary to start at one side and work across to the other side, covering a convenient stretch on the way. Brush the paint out thoroughly to a thin, even coating. Brushing up and down as well as across insures thorough covering and reduces brush marks. After all the surface within arm's length has been covered, "lay off" by drawing the empty brush lightly and smoothly across the entire length of the freshly painted piece, from the edge of the unpainted surface toward that which has been finished. On wood use long sweeping strokes parallel to the grain. Allow the brush to follow the hand at an angle to the surface, raising it gradually upon reaching the surface previously laid off. On stopping work for the day, be sure that the painted surface is defined by a straight line, such as the lower edge of a weather board or course of shingles. The application of fresh paint over the edge of paint that has already set causes unsightly laps.

Shingle stains and whitewash do not require any particular skill or special care for application with brushes. Spattering should be avoided if possible, and the material should be kept stirred while in use. Very dry surfaces should be moistened before whitewashing. When cold-water paint is applied by a brush to continuous outside surfaces, such as plaster or cement, the same care is required as for interior calcimining (p.30).

As flat-finish paints set almost as soon as they are put on, interior painting must be done more carefully than outside painting. Spread the paint on the surface and lay off quickly, brushing as little as possible. Once set, do not touch it with the brush. Finish a small section with each brushful of paint and work in narrow stretches. Do not overlap an adjoining section. Join two adjacent sections with light finishing strokes, which should be curved or semicircular rather than straight back and forth and should extend barely over the edges of the section previously painted. If all the brushing is done when the paint is first applied and the painted surface is not disturbed, the paint will level itself and hide the brush marks. Paint walls from top to bottom, using curved up-and-down strokes rather than cross strokes. An entire wall or ceiling should be finished without interruption. It is better for two or more persons to work on one wall or ceiling, with the windows open, than for one person to work in an atmosphere saturated with the vapor of paint thinners, with the windows shut. Because of the rapid evaporation of vehicle and thinner, paint pots should be only partly filled when using flat-finish paints and the bulk of the paint should be kept in closed containers.

To produce a stippled finish, apply a flat wall paint somewhat thicker than that ordinarily used, and dab the surface before the

paint sets with a stiff dry brush held at right angles. A regular stippling brush is best.

To produce a mottled finish, apply wall paint over a ground color of another shade, and while it is still wet touch the surface lightly with crinkled wrapping paper loosely held.

To produce a blended finish, apply two or three coats of wall paint of ground color, stippling the last coat with a ball of cheesecloth. When the surface is dry apply a glazing or lake color harmonizing or contrasting with the ground color, thinned with linseed oil or turpentine and a little drier. While the surface is still wet, wipe away the last coat in spots with a cloth, so that the ground color shows through more in some places than in others. When two or more glazing colors are desired, each color is applied in irregular patches with a separate brush, and the edges of each patch are dabbed with a ball of cheesecloth, after which the entire surface is stippled with a brush.

CALCIMINING

Use special calcimining brushes. Spread the material, which should be as thick as possible without leaving brush marks when applied, thickly and evenly over the surface with the least possible brushing. The object is to hide the surface with one coat; an attempt to apply a second coat may remove the first. If a second coat is necessary, as it may be on very smooth plaster, it should be thin, and the surface should be brushed over very lightly and carefully with a solution of alum just before it is applied.

Have the room as light as possible and cover the surface completely and uniformly. Work in narrow stretches across spaces in the shortest direction. Always start in a corner and work away from the light. To keep laps from showing, the edge of one stretch must not be dry when being joined with the next. Drafts and warm ceilings and walls make coatings dry too quickly. If the edge of a stretch dries, apply plain water with a clean brush lightly and carefully before joining it with the next stretch. In joining do not apply more pigment to the lap than elsewhere, but work the paint of one stretch into the edge of the preceding one by gentle brushing. After the coating is on give all the ventilation possible; if the air is full of moisture, heat the room. Slow drying may cause a spotted appearance.

VARNISHING AND ENAMELING

Do not brush out varnish and enamel thoroughly like ordinary house paints, but flow them on to the surface by means of special varnishing and enameling brushes held obliquely, with just enough light brushing to even them and spread out the excess to prevent sags or runs. Varnishes and enamels, designed to be self leveling, soon become tacky with continued brushing.

Before varnishing, sandpaper the surface perfectly smooth. Unless a natural finish is desired, first apply an oil, water, or spirit stain to new wood and treat open-grain woods, such as oak, chestnut, ash, elm, walnut, and mahogany, with a paste wood filler according to the directions on the cans. The filler can be colored to match the stained wood, although this may not be necessary as the filler is usually transparent under varnish. Sometimes a light filler is used on a dark wood

for a special effect. After the filler has dried smooth the surface with sandpaper. Several coats of varnish may be necessary. Before applying a new coat, remove the gloss from the previous one after it has become dry and hard, by rubbing it with very fine steel wool, curled horsehair, or wet felt dipped in powdered pumice stone. If pumice stone is used, keep the surface wet. Do not allow any pumice to dry on the varnished surface, but sponge it off immediately with clean water and dry the surface with chamois skin or a clean cloth.

A rubbed or satin finish having a dull luster is sometimes given to the last coat of varnish by rubbing either with powdered pumice and water as described or with powdered pumice alone, using a block covered with thick felt saturated with mineral oil. A high polish or piano finish can be produced on certain varnishes that have become thoroughly dry and hard by using pumice stone, followed by polishing with oiled felt and rottenstone, using the palm of the hand for the final rubbing.

Enamel should not be applied until the surface has been given two or more coats of flat-finish paint of the same color. Special undercoating paints may be used with enamels, but ordinary paint is satisfactory if most of the linseed oil in it is poured off when the pigment is well settled, and enough turpentine or mineral spirits, containing some extra drier, is added to give a flat finish. Before the enamel is applied, the surface should be smoothed with fine sandpaper.

If the surface has been enameled before, remove the gloss of the old coat, by rubbing with curled horsehair, fine sandpaper, or steel wool.

To give the surface a satin finish, use special varnishes and enamels which dry with a subdued luster.

To give a stained and varnished appearance to painted wood, treat the surface with a crack and crevice filler, unless it is perfectly smooth and free from cracks. Then paint with a ground color for graining (flat-finish cream) and let it dry thoroughly. Next sandpaper the surface and grain it with distemper paint, using rubber graining tools. Each board or other well-defined surface should be grained separately. After the grain color has dried apply a varnish stain.

SPRAY PAINTING

Special spraying devices are used extensively for applying water paints to large interior surfaces and in factories for finishing automobiles, furniture, hardware, and machinery. The results first obtained with exterior spray painting did not compare very favorably with those obtained with brush painting, but as the machines have been improved and more experience gained spray painting has become more satisfactory. A good operator can cover a surface adapted to spray painting as well by using a good machine as by hand brushing and in much less time. This method is particularly good for large surfaces with few openings and little or no trimming. As spray painting outfits are expensive and experience and practice are necessary for their successful operation, this method will be used almost entirely by painting contractors and others who have a great deal of painting to do. With an air brush or paint gun the space is covered so quickly that it must be done right the first time. Any attempt

at improvement by going over the same surface a number of times results in too much paint.

The only kind of spray painting that does not require the services of an expert is whitewashing. When properly thinned and strained whitewash can be applied with a bucket or barrel-spraying outfit, such as is used for spraying fruit trees. The nozzle for Bordeaux mixture is suitable for whitewash. Application of whitewash with a high-pressure spray pump is better than brushing because it insures penetration of cracks and crevices.

DIPPING

Dipping is another labor-saving method of paint application confined chiefly to factory practice. Articles varying in size from toys to parts of large machines are coated in this way. When the paint is especially well adapted to the purpose and the drying conditions are properly controlled, the coating is continuous, uniform, and durable.

The only other common use of the dipping method is in painting or staining shingles. Shingles should be dipped to cover about two-thirds their length and should be kept in the material long enough to thoroughly color the surface. They should then be set in a trough, tipped to permit the excess of liquid to drain back into the dipping vessel. Shingles that have been dipped in paint should be brushed lightly on both sides to remove the excess.

PRECAUTIONS

Do not use white-lead paints in places where they will come in contact with drinking water, silage, or food products.

Do not inhale the dust when scraping or sandpapering surfaces coated with lead paints. If dust can not be avoided, cover the mouth and nose with loose cotton inclosed in several thicknesses of cheesecloth or with a respirator or mask. Keep the skin as free as possible from paint and thoroughly clean the hands before eating, using oil or grease to remove most of the paint, followed by soap and water. Handling food with hands that are covered with lead paint is dangerous.

When painting or varnishing indoors keep the windows opened enough to permit free circulation of air.

Keep paints, varnishes, oils, and thinners away from heat and flames; they are inflammable.

Dispose of all rags or waste containing paint, varnish, or oil in such a way as to avoid the possibility of fire from spontaneous combustion.

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March 31, 1925

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